

DETAILS OF THE WEATHER IN THE UNITED STATES

GENERAL CONDITIONS

Like the two immediately preceding months, April, 1925, was warm in practically all parts of the country, especially east of the Mississippi and south of the Ohio during the last 10 days of the month. Thus the temperature has been above normal for three consecutive months.

Precipitation, as a rule, was mostly below normal, except in Arkansas, Oklahoma, western and northern Texas, where drought was relieved during the last decade.

As in the two immediately preceding months, pressure in Alaska and the Canadian Northwest was lower than usual; pressure in the North Pacific HIGH was, however, above normal. No cases of general and pronounced southward flows of polar air occurred.

CYCLONES AND ANTICYCLONES

By W. P. DAY

The number of low-pressure areas charted during April showed a decided decrease as compared with the colder months preceding, indicative of the lessened interchange of air between the pole and the Equator with the arrival of warmer weather. Also most of the cold high-pressure areas coming from Canada pushed southward from the region of Hudson Bay, while only one came southward from the Mackenzie Valley. In general this may be attributed to the effect of Hudson Bay in retarding the rise in temperature over northeastern Canada, giving a strong temperature gradient from east to west over northern Canada and a preponderance of high pressure over the colder regions. These Hudson Bay HIGHS affected only the Northeastern States, while the single HIGH from northwestern Canada on the 27th and 28th brought cool weather generally east of the Rockies.

FREE-AIR SUMMARY

By V. E. JAKL

Free-air temperatures showed positive departures of practically the same amount as the temperatures at the surface (Chart III in this REVIEW). Thus, in eastern North Dakota both the surface departure and the departure up to the limits of observation were about 9° F. (Ellendale, Table 1). The slight diminution of the departure with altitude noted at Ellendale and some other stations, and the slight increase at still others, is very likely due to the fewer observations at the higher levels; therefore, a practically uniform departure at all observed altitudes for all stations may be taken for granted. Some indication of the cause of these conditions is shown by the observations at Broken Arrow, Drexel, and Ellendale on the 21st and 22d, made in south component winds of considerable depth in the front of an extensive and well-defined depression. On one or both of these dates temperatures from 9° to 15° F. above normal up to about 4,000 meters were recorded.

Notwithstanding the higher average free-air temperatures, there was about the usual amount of cloudy weather and precipitation; consequently the relative humidity was about normal and the vapor pressure above normal over all stations and at all altitudes for which reliable averages were obtained.

Table 2, together with the resultants of pilot balloon observations, shows that above 2,000 meters the wind

direction was generally about normal, i. e., nearly due west, and of slightly less than normal velocity. Below 2,000 meters, the winds were of variable strength and velocity, both from level to level and from station to station. At these lower levels, therefore, as might be expected, the wind resultants showed no close agreement with the normal.

In considering the average free-air winds for the month a certain relation between them and the character of precipitation is at once apparent. As the precipitation approaches the summer type of occasional showers and thunderstorms the wind directions and velocities are found to become correspondingly more variable than during the colder season. There is a tendency to an instability of the air peculiar to the spring months, due to lag in the seasonal increase of temperature aloft. This instability, combined with the rapid changes in wind direction, apparently accounts for many if not most of the cases of precipitation occurring during this time of year.

On numerous occasions during this month showers and thunderstorms began simultaneously with change in direction of wind and fall in temperature—or with fall in temperature alone—observed at the surface. To what depth these changes extend aloft can not often be determined, owing to the danger of flying kites during showers and thunderstorms. However, there are some observations available made near enough to the time of occurrence of precipitation to serve as illustrations. At Drexel on the 13th a record finished just before a thundershower began clearly shows a rapid fall in temperature and rise in humidity aloft and rising temperature and falling humidity near the ground, this change to opposite values causing a rapid approach to a dry adiabatic lapse rate and eventually falling temperature on the ground. The ensuing thunderstorm with its attendant drop in surface temperature was evidently caused by a wedge of cold air that had built up from the ground immediately to the northwest of Drexel. The free-air record for Drexel on this date is shown in the following table:

Altitude, M. S. L. meters	Time	Tem- pera- ture	Rela- tive humid- ity	Wind direc- tion	Time	Tem- pera- ture	Rela- tive humid- ity	Wind direc- tion
396.....	7:16 a. m..	° C. 13.5	Per cent 72	WNW	1:10 p. m..	° C. 23.0	Per cent 30	SW.
Surface:								
1,000.....	7:31 a. m..	12.7	48	NW	1:01 p. m..	15.7	41	W.
2,000.....	7:47 a. m..	7.5	33	NNW	12:44 p. m..	4.9	67	WNW.
3,000.....	8:22 a. m..	1.1	34	NW	12:27 p. m..	-3.8	42	NW.
4,000.....	8:48 a. m..	-4.3	25	WNW	12:11 p. m..	-10.4	45	W.
5,000.....	9:42 a. m..	-9.4	14	WNW	11:44 a. m..	-14.6	34	W.
6,000.....	11:05 a. m..	-15.9	25	W				

The effect of the eastward movement of this condition is shown by the surface record at Royal Center, 500 miles east of Drexel, where four hours later a thundershower occurred, with an abrupt wind shift from south to west and decided fall in surface temperature. The morning observation at Royal Center shows southeast winds at the surface veering to southwest aloft, while that of the following morning shows northerly winds at the surface backing to westerly aloft. The pressure distribution shows Drexel in the rear of a LOW on the morning of the 13th, and Royal Center to the south of

the LOW on the evening of the same day, the LOW having in the meantime passed northeastward.

A somewhat similar succession of events at two stations is noted on the 26th over Broken Arrow and Groesbeck, about 300 miles apart in a north-south line. A thunderstorm, attended by a shift in wind from south to northwest and a drop in temperature at the surface, began at Broken Arrow at 6 p. m., and 4 hours later at Groesbeck, where the drop in temperature was accompanied by a shift from southwest to northwest. Kite and pilot balloon observations at these stations show a change from southerly winds veering with altitude on the 26th to northwesterly winds backing with altitude on the 27th, attending the development of a Low in the southwest and its movement eastward.

A few instances of easterly winds aloft are noted, principally during the first few days of the month in the southern portion of an area of high pressure that moved southeastward from the Canadian Northwest to the Southeastern States. It is significant, however, that in only a few instances were these easterly winds observed to very high altitudes, as in spring the normal latitudinal temperature gradient is still strongly established, while easterly winds extending to high altitudes require a reversal of this temperature gradient to a considerable depth.

The principal instances of strong winds aloft are noted on the 23d and 24th in connection with a pronounced low that moved northward over middle sections of the country. Stations in the immediate influence of this low showed strong winds on the ground, increasing rapidly with altitude, while at stations more remote from the low the wind increased from light on the ground to gale force aloft.

The highest kite flight of the month reached 7,023 meters at Ellendale, on the 10th. This lacked only a few meters of equaling the previous record established at that station for highest altitude above sea level reached in this country in recent years. The flight was made to the south of a LOW approaching from the northwest, and showed southwest winds at the surface veering to northwesterly in the upper altitudes, with an inversion in temperature to 1,000 meters and a continuous fall in temperature at the rate of nearly 0.8° per 100 meters to the topmost altitude of the observation.

TABLE 1.—Free-air temperatures, relative humidities, and vapor pressures during April, 1925

Altitude M. S. L. (m.)	Broken Arrow, Okla. (233 m.)		Drex- ., Nebr. (396 m.)		Due West, S. C. (217 m.)		Ellendale, N. Dak. (444 m.)		Groesbeck, Tex. (141 m.)		Royal Center, Ind. (225 m.)	
	Mean	De- part- ure from 7-yr. mean	Mean	De- part- ure from 10-yr. mean	Mean	De- part- ure from 5-yr. mean	Mean	De- part- ure from 8-yr. mean	Mean	De- part- ure from 7-yr. mean	Mean	De- part- ure from 7-yr. mean
Surface..	19.0	+3.2	14.1	+4.9	18.6	+1.2	9.9	+4.1	20.1	+1.6	13.5	+2.2
250.	18.9	+3.2			18.3	+1.3			19.3	+1.5	13.3	+2.2
500.	18.7	+4.5	13.6	+5.1	16.0	+1.2	9.5	+4.0	17.6	+1.4	11.7	+2.9
750.	17.1	+4.4	12.7	+5.8	14.3	+1.2	8.4	+4.3	16.4	+1.3	10.9	+3.4
1,000.	15.8	+4.2	11.2	+5.4	13.2	+1.4	7.5	+4.5	15.5	+1.2	9.9	+3.7
1,250.	14.6	+4.2	9.7	+4.9	11.8	+1.3	6.1	+4.2	15.1	+1.6	9.1	+4.1
1,500.	13.2	+3.9	8.3	+4.5	10.1	+1.0	4.6	+3.9	14.3	+1.5	8.0	+4.1
2,000.	10.5	+3.7	5.2	+3.7	6.6	+0.5	1.3	+3.1	12.3	+1.6	5.4	+3.6
2,500.	7.5	+3.6	2.0	+3.1	4.0	+0.4	-2.0	+2.0	9.9	+1.9	3.0	+4.1
3,000.	4.4	+3.6	-1.3	+2.6	1.0	-0.1	-6.2	+1.4	7.0	+1.8	0.9	+4.7
3,500.	1.3	+3.6	-4.2	+2.7	-2.6	-1.1	-9.8	+0.8	4.3	+1.9	-1.8	+4.6
4,000.	-1.6	+3.7	-7.3	+2.7	-6.6	-2.8	-13.2	+0.6	1.8	+2.5	-4.5	+4.1
4,500.	-4.5	+3.7	-10.7	+2.3			-17.2	-0.4			-7.2	+4.2
5,000.	-7.8	+3.6	-13.4	+2.5			-21.2	-1.1				

RELATIVE HUMIDITY (%)

Surface	64	0	60	-5	55	-5	62	-5	70	-1	61	-2
250	64	0			55	-5			71	0	61	-2
500	63	0	57	-7	57	-4	62	-4	71	0	60	-3
750	62	0	52	-11	57	-4	60	-4	68	+2	57	-5
1,000	61	+1	52	-10	55	-7	60	-2	64	+3	54	-7
1,250	59	+1	52	-9	58	-4	61	0	56	0	50	-9
1,500	50	+4	51	-8	64	+2	59	0	50	-1	49	-9
2,000	58	+6	51	-6	70	+9	54	-2	40	-5	50	-7
2,500	56	+5	53	-4	64	+9	53	0	37	-6	46	-9
3,000	53	+3	53	-3	60	+11	64	-1	41	-1	45	-8
3,500	49	-3	53	-3	59	+14	58	0	48	+4	41	-12
4,000	46	-3	48	-7	62	+17	60	+4	47	0	31	-19
4,500	50	+1	42	-12			65	+9			21	-27
5,000	58	+5	39	-13			70	+15				

VAPOR PRESSURE (mb.)

Surface	14.12	+2.20	9.44	+1.81	12.08	-0.25	7.36	+1.25	16.53	+1.05	9.72	+0.83
250	14.01	+2.20	-----	-----	11.95	-0.20	-----	-----	16.08	+1.31	9.00	-0.86
500	11.47	+2.01	8.88	+1.62	10.82	-0.03	7.19	+1.25	14.55	+1.51	8.54	+1.01
750	10.17	+1.83	7.75	+1.27	9.77	-0.02	6.04	+1.38	12.75	+1.12	7.07	-0.91
1,000	10.17	+1.78	6.34	+1.15	8.28	+0.11	6.35	+1.58	11.04	-0.52	6.09	-0.80
1,250	9.12	+1.76	5.62	-0.97	8.28	+0.11	6.01	+1.68	11.04	-0.52	6.09	-0.80
1,500	8.43	+1.68	5.07	-0.77	7.06	-0.72	5.80	+0.76	7.23	+0.26	5.52	-0.50
2,000	6.46	+1.19	4.44	-0.59	6.80	+1.15	3.80	-0.76	5.20	-0.29	5.06	-0.19
2,500	4.94	-0.74	3.73	+0.50	5.34	+1.14	2.98	-0.55	4.21	-0.31	3.41	-0.11
3,000	3.70	-0.31	2.95	-0.28	4.38	+1.25	2.07	-0.14	3.10	+0.41	2.84	-0.22
3,500	2.72	-0.09	2.35	+0.18	3.66	+1.24	1.61	-0.04	4.00	+0.81	1.98	-0.26
4,000	2.18	-0.06	1.67	-0.02	3.33	+1.38	1.31	-0.06	3.71	+1.02	1.22	-0.69
4,500	1.95	+0.14	1.26	-0.06	-----	-----	1.11	-0.17	-----	-----	0.69	-0.85
5,000	1.72	+0.15	1.06	-0.01	-----	-----	0.93	-0.23	-----	-----	-----	-----

TABLE 2.—Free-air resultant winds (m. p. s.) during April, 1925

Altitude, M. S. L. in.	Broken Arrow, Okla. (233 m.)				Drexel, Nebr. (396 m.)				Due West, S. C. (217 m.)				Ellendale, N. Dak. (444 m.)				Groesbeck, Tex. (141 m.)				Royal Center, Ind. (225 m.)				
	Mean		7-year mean		Mean		10-year mean		Mean		5-year mean		Mean		8-year mean		Mean		7-year mean		Mean		7-year mean		
	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.			
Surface	S. 9°E.	3.5	S. 1°W.	2.8	S. 13°E.	1.8	S. 26°E.	0.4	S. 60°W.	1.3	S. 82°W.	1.4	N. 14°W.	1.4	N. 11°W.	1.6	S. 2°E.	3.0	S. 5°E.	2.5	S. 82°E.	0.7	S. 52°W.	1.9	
250	S. 9°E.	3.6	S. 1°W.	2.9					S. 61°W.	1.3	S. 79°W.	1.5					S. 1°E.	4.0	S. 3°E.	3.2	S. 70°E.	0.6	S. 45°W.	2.1	
500	S. 1°E.	4.9	S. 9°W.	4.2	S. 14°E.	2.5	S. 10°E.	0.6	S. 67°W.	1.7	S. 75°W.	2.4	N. 7°W.	1.3	N. 11°W.	1.5	S. 2°W.	5.3	S. 4°W.	4.7	S. 78°W.	1.4	S. 42°W.	4.0	
750	S. 3°W.	5.3	S. 13°W.	5.2	S. 14°E.	2.9	S. 38°W.	0.6	S. 60°W.	1.5	S. 69°W.	3.0	N. 3°W.	0.8	N. 20°W.	0.8	S. 5°W.	5.6	S. 10°W.	5.4	S. 75°W.	2.2	S. 50°W.	5.1	
1,000	S. 16°W.	5.3	S. 25°W.	5.6	S. 6°E.	2.6	S. 55°W.	1.2	S. 60°W.	1.5	S. 63°W.	3.7	S. 60°W.	0.7	N. 53°W.	1.0	S. 9°W.	6.4	S. 21°W.	6.1		W.	2.4	S. 55°W.	5.8
1,250	S. 33°W.	5.4	S. 36°W.	5.8		1.8	S. 70°W.	2.0	S. 52°W.	2.0	S. 66°W.	5.1	S. 63°W.	1.7	N. 61°W.	1.8	S. 21°W.	6.8	S. 32°W.	6.5	N. 78°W.	3.7	S. 68°W.	6.5	
1,500	S. 43°W.	5.1	S. 50°W.	6.4	S. 20°W.	1.7	S. 78°W.	3.0	S. 63°W.	2.9	S. 69°W.	6.3	S. 68°W.	2.3	N. 64°W.	2.3	S. 30°W.	7.0	S. 37°W.	7.2	N. 73°W.	5.2	S. 77°W.	7.3	
2,000	S. 57°W.	6.3	S. 60°W.	7.6	S. 28°W.	2.1	S. 86°W.	4.3		W.	3.1	S. 81°W.	7.7	S. 60°W.	3.9	N. 80°W.	3.0	S. 42°W.	6.8	S. 48°W.	8.0	N. 79°W.	6.3	S. 84°W.	8.3
2,500	S. 55°W.	7.1	S. 69°W.	8.4	S. 73°W.	2.8	S. 88°W.	6.2	S. 83°W.	6.2	S. 82°W.	9.8	S. 64°W.	4.9	N. 88°W.	4.6	S. 65°W.	4.9	S. 58°W.	8.5	N. 32°W.	6.4		W.	8.4
3,000	S. 70°W.	6.4	S. 79°W.	8.3	S. 79°W.	6.3	S. 88°W.	8.7	S. 70°W.	6.2	S. 83°W.	10.1	S. 81°W.	6.5	N. 82°W.	6.2	S. 77°W.	5.6	S. 64°W.	10.5	N. 4°W.	10.5	N. 86°W.	9.8	
3,500	S. 78°W.	8.6	S. 83°W.	11.0	S. 85°W.	6.8	S. 88°W.	10.1	N. 75°W.	7.8	N. 85°W.	11.8	S. 85°W.	6.9	N. 85°W.	7.7	S. 74°W.	6.8	S. 69°W.	10.4	N. 2°W.	10.2	S. 83°W.	11.2	
4,000	S. 84°W.	11.6	S. 83°W.	12.4	N. 64°W.	4.7	N. 86°W.	11.1	S. 71°W.	6.3	N. 77°W.	13.6	N. 50°W.	10.6	N. 79°W.	8.8	N. 58°W.	5.4	S. 85°W.	11.9	N. 68°W.	15.1	S. 87°W.	13.5	
4,500	N. 87°W.	12.8	S. 82°W.	14.2	N. 73°W.	7.8	N. 78°W.	12.9	N. 67°W.	13.0	N. 52°W.	14.9	N. 40°W.	12.9	N. 64°W.	8.7						N. 67°W.	14.0	N. 89°W.	11.4
5,000	N. 66°W.																								